Mecheleciv

THE GEORGE WASHINGTON UNIVERSITY
SCHOOL OF ENGINEERING

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FALL MIXER HELD

by W. J. J. Klein

The Engineers' Fall Mixer was held on Wednesday evening, October 13, in Government 1. The program was opened at 8:15 p.m. by Larry Brown, the President of the Engineers' Council, who acted as master of ceremonies. The students and guests present were introduced first to Dean Feiker, then to the society and fraternity presidents, and to Mr. Philias H. Girouard, President of the G.W.U. Engineer Alumni Association, and Mr. M. N. (Pop) McKnight, Vice President of the Engineer Alumni Association. Mr. Girouard and Mr. McKnight both pointed out the advantages of th engineering societies to the engineering stud ts. Mr. Waldo E. Smith, of the C. E. Department, spoke briefly about the importance of joining the engineering societies and supporting them. The heads of the departments of the Engineering School were introduced and they in turn introduced the instructors of their respective departments.

The meeting was then turned over to the speaker of the evening, Mr. Goertzenberger, and after his speech and the discussion that followed, the meeting adjourned to the Student Club for refreshments. Here opportunity was given to interested students to join the societies and to subscribe to Mecheleciv. All in all, it was an enjoyable and profitable meeting, serving well its purpose of engineering friendship and sociality.

MR. GOERTZENBERGER SPEAKS BEFORE MIXER

The guest speaker of the Fall Mixer, was Mr. R. L. Goertzenberger, vice president of Minneapolis-Honeywell Regulator Company. Mr. Goertzenberger's topic was "Personal Development of Engineers," a subject with which he has long been familiar both an an engineer, a businessman, and as an important member of the Engineers' Council for Professional Development.

In his opening remarks, Mr. Goertzenberger stated that in the field of engineering only 10% of the discharges were for lack of technical knowledge or specific skill, whereas 90% of the discharges were due to personality characteristics.

(*Continued on page 6*)

ON BEING "PROFESSIONAL"

by Frederick M. Feiker
Dean of Engineering

A recent conference at Carnegie Institute of Technology on the objectives of a professional education brought together representatives of schools of divinity, law, medicine, engineering and business. It fell to the lot of the newest profession, that of business, to open the conference with a statement of the objectives and general provisions of a professional business education. Perhaps, because there is less tradition in this new field of education, the statement seemed to me to present the attributes of a professional view point of special interest to the "second newest profession," that of engineering. A professional engineer as we know practices for his clients' good within the framework of technology and economics. If he is a professional man he must make his decisions on *values* as well as on technology and costs.

Dean Donald David of the Harvard Graduate School of Business, listed eight abilities that each student must have or acquire, as follows: Ability to analyze, to organize, to deal with people, to select and train subordinates, to use figures for effective control, to establish standards, to judge performance and ability in oral and written communication. In addition a student of a profession must have knowledge of his field, acquaintance with the sources of technical information, and understanding of his professional organizations; these are "know how" and "know where." Finally, he must understand the place of his profession in society, be guided by a code of ethics and, not least, have a spirit of vigorous and courageous enterprise.

Not everyone might agree exactly with this analysis, but all would recognize that in this presentation of personal development, of technical knowledge and of high ideals of service, these educational needs are applicable to all professions —with technical knowledge the only part of the training which varies between professions. Certainly we have agreed many times that what counts in professional life is not knowledge alone, but how well we apply it for our clients' good

The Heat Pump

by Norman R. Miller

The heat pump has advanced considerably since it was first suggested by Lord Kelvin in 1852. In 1852 he predicted: "When Niagara is set to work for the benefitt of North America—(the heat pump) will no doubt be largely employed for the warming of houses over a considerable part of Canada and the United States." [1]

Evidence of this advance is seen in two local installations: Bertram's Pipe Store Building at 918 14th tStreet, N.W., and the Executive Pharmacy Drug Store Building at 909 Pennsylvania Avenue, N.W. However, before reviewing these installations it would be well to consider the fundamental heat pump cycle and its principle of operation.

Often the heat pump is called a reversed refrigeration machine. This is not exactly a true description of its operation, for the heat pump operates in exactly the same way as a mechanical refrigerator, differing only in its ultimate purpose. For example, the ordinary household refrigerator functions as a device to pick up heat in the evaporator (which is located inside the box) and dispose of this heat in the condenser (which is located outside the box and gives up the heat to the air circulating in the kitchen). The prime purpose of the refrigerator is to cool and no regard is given to the disposal of the heat picked up in cooling. It is simply "thrown away." The heat pump works in exactly the same way except that its prime purpose is to heat. Therefore, this discarded heat becomes the important item. The only difference between the two is therefore a matter of functioning. In the refrigerator we "save the cold", whereas in the heat pump we "save the heat." The cycle is fundamentally the same for both systems.

Notice the schematic diagram of a household mechanical refrigerator as shown in Figure

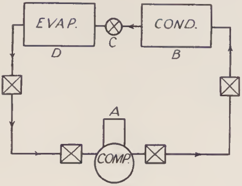


Figure 1

I. The refrigerant is put under high pressure and temperature in the compressor (A). and from there is pushed through the condenser (B), where air from the kitchen is blown over the coils. The refrigerant is thus cooled and liquefies. From here the refrigerant flows to the expansion valve (C), where its pressure is decreased. It then boils in the evaporator (D), thus cooling the inside of the refrigerator box, and is finally pumped back to the compressor, completing the cycle.

Suppose, in Figure I, that the condenser (B) is located in the living room of a house with a fan blowing over it, and the evaporator (D) is located outside the house. The refrigerant flows through the valve (C), boils, and picks up heat from outside. Then the refrigerant travels through the compressor (A) and into the condenser. Here a fan circulates the room air over the hot coils, and thus the room is heated. This is the heat pump operating in its simplest form as a heating unit. Figure 2 shows how, by means of four valves, the functions of the evaporator and condenser can be reversed and the system operated as a cooling unit.

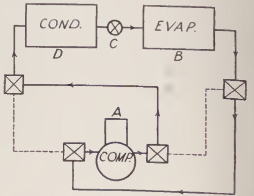
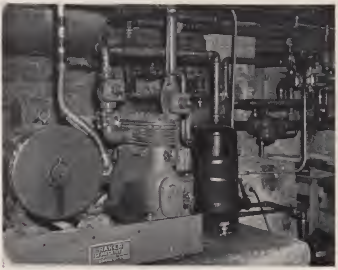


Figure 2

The Bertram's Pipe Store Building consists of four stories and a basement, constructed of 13 inch brick wall, with two story high party walls on both sides. The over-all dimensions are 30 feet in width and 80 feet in length. The first floor is primarily a sales room, approximately 29 feet wide, 65 feet deep and 13 feet high, with a mezzanine located above the entrance. The third floor is a shop for manufacturing pipes. These areas are the only ones which are heated and cooled directly by the heat pump, and they constitute an approximate volume of 72,360 cubic feet.

The heat pump equipment is located in the basement and includes a 20 HP "Baker" freon compressor, a 50 gpm water pump with 5 HP motor, and an air circulation fan driven by a 3 HP motor. The system operates at a suction pressure of 32 psi and discharge pressure of 180 psi on the heating cycle. The discharge pressure is reduced to 120 psi on the cooling cycle, with the suction pressure staying the same as on the heating cycle This gives the system a theoretical COP (Coefficient of Performance) of 4.98 for the heating cycle and 7.51 for the cooling cycle. Since this system was sized for winter load requirements, the COP for summer operation is very high as it is operating on part load only. Tables I and II show data which has been taken on this unit in actual operation. It can be seen that during the hottest part of the summer the system ran at approximately half capacity, while during the coldest part of the winter it operated at two-thirds capacity. From this we see that the COP for cooling is higher.



Bertram's Pipe Store Installation

The source of heat for this unit is well water which maintians an average year-round temperature of 62° F., and is rejected from the condenser at a temperature of 51° F. The changeover of the system from heating to cooling and vice versa is not automatic. Manually operated valves in the lines are tagged with instructions to "Open" or "Close" for the required operation.

The Executive Pharmacy Building is also constructed of 13-inch brick walls and has party walls which are two stories high on both sides. The building dimensions are 30 feet wide by 110 feet deep. The first floor is a drug store and sales area with a volume of approximately 32,300 cubic feet. This is the only area of the building which is heated directly by the heat pump, the basement, second and third floors having no facilities for heating or cooling.

The heat pump equipment consists of a 15 HP Frick Freon Compressor, a 15 gpm water pump with 3 HP motor, and a 2 HP air circulation fan. The source of heat is well water at a temperature of 55° F. This unit has been in successful operation for the last ten years. Prior to August 4, 1947, a 10 HP motor was used on the compressor, but was found inadequate for the summer cooling load. Consequently at this time, the 15 HP motor was installed along with additional cooling coils. The 10 HP motor was entirely adequate for heating, but as will be shown later, the summer cooling load was the determining factor in the sizing of this installation. The size of the motor had to be increased to satisfactorily handle this load.

This system was designed to have no recirculation of air from the occupied space during summer or winter. Fresh air is taken direct from the outside through the heat coil carrying well water and a second coil connected to the refrigeration compressor. This fresh air duct, without insulation, is erected in the ceiling of the kitchen space, and therefore absorbs some heat from the excessive high air temperatures when the kitchen equipment is in full use. Normally, the lightweight glass front doors stand open approximately one inch due to the air pressure caused by this introduction of fresh air for heating or cooling. Tables III and IV show some data which has been taken on this unit in actual operation.

A comparison of these two systems shows an interesting difference in functioning, and hence, in design. The unit at Bertram's Pipe Shop, designed primarily as a source of heat for winter operation, runs only at part load on the cooling cycle and is most economical during this period. In contrast, the Executive Pharmacy is provided with a large amount of heat all year round from the electric and gas cooking equipment in the kitchen and food service area. A large amount of solar heat is also received through the large glass windows in the front of the store (facing South). In consideration of

this, the system was designed with a maximum summer cooling load in mind. Thus, the most economical operation of this unit is obtained during its operation as a heating unit (during the winter).

Both of these units were designed by Mr. Fred C. DuMond, 3515 Paterson Street. N.W. and continual data is being taken on them by the Potomac Electric Power Company of Washington, D. C. From this data, it has been determined that their cost of operation compares favorably with a similar oil or gas installation. In addition, the heat pump installations have one big advantage which is becoming increasingly more important every year; there is no dependence on supply of fuel. This advantage, coupled with the desire for summer cooling as well as winter heating, which is almost compulsory for a commercial establishment today, makes the heat pump a serious contender in the field of heating and ventilation.

BERTRAM'S PIPE STORE BUILDING
918 14th Street, N.W.

TABLE I—HEATING CYCLE

Meter Reading Date	Consumption—Kwhrs. Comp.	Pump	Fan	Total	Degree Days	Kwhrs. per deg. day per 1,000 cu. ft. of heated space	Load factor for each period
2-12							
3-10	5809	933	1229	7961	808	0.136	66.4
4- 8	2132	635	718	3485	547	0.0885	26.0
5- 7	210	365	133	708	194	0.0507	4.1

TABLE II—COOLING CYCLE

Meter Reading Date	Consumption—Kwhrs. Comp.	Pump	Fan	Total	Kwhrs. per 1000 cu. ft. of Cooled Space	Load factor for each period
5- 7						
6- 6	1099	342	201	1642	22.7	19.0%
7- 9	2040	432	391	2863	29.6	33.2%
8- 7	2847	661	475	3983	55.0	47.6%
9- 8	3786	663	574	5023	69.5	54.5%
10- 7	1307	404	202	1913	26.4	22.8%

EXECUTIVE PHARMACY
909 Pennsylvania Avenue, N.W.

TABLE III—HEATING CYCLE

Meter Reading Date	Consumption—Kwhrs. Comp.	Pump	Fan	Total		Kwhrs. per deg. day per 1,000 cu. ft. of heated space	Load factor for each period
2- 4							
3- 5	1814	926	611	3351	964	0.108	33.4
4- 3	496	919	610	2025	648	0.094	20.2

TABLE IV—COOLING CYCLE

Meter Reading Date	Consumption—Kwhrs. Comp.	Pump	Fan	Total	Kwhrs. per 1,000 cu. ft. of Cooled Space	Load factor for each period
4- 3						
5- 2	1385	811	931	3127	97	24.6%
6- 3	3032	990	1068	5090	158	37.4%
7- 3	4002	983	1051	6036	187	47.4%
8- 4	4371	1051	1104	6526	202	48.0%
9- 4	5373	974	1066	7413	230	48.2%
10- 2	3444	902	998	5344	165	38.4%

Tables I, II, III and IV are taken from "Report of Two Heat Pump Cases (1947 Operations)," prepared by the Commercial Engineering Department of the Potomac Electric Power Co., Wash., D.C.

Engineering Fraternities

THETA TAU

Gamma Beta chapter of Theta Tau, GW's National Professional Engineering Fraternity, held its formal biannual initiation October 16 in Lisner Auditorium, followed by a banquet and dance at the Rodger Smith. Bouquets to Dean Feiker and Prof. Ames for their very nice speeches at the banquet. The 21 pledges, along with actives and alumni, dusted off and doned tuxes for the occasion, but it must be admitted that these poor males were far outshone in splendor by the bevy of young ladies at the dance. And who wouldn't have it that way. The evening was a great success, some of those present were told later, and Theta Tau was once again off to an auspicious start for the school year.

Those members initiated on Oct. 16 were: Allnutt, Ralph B.; Bell, Ivan F.; Braugh, Frank C.; Chambliss, Charles E.; Davis, Donald V.; Edson, Frank W.; Elf, Martin A.; Fram, William Jr.; Hix, Ernest T., Koester, Richard E.; Kushman, Hollis K.; Lewis, John W.; Lippitt, Edward G.; McGee, Hillis; Michael, Jerrold M.; Myers, Charles F.; Reddle, Victor L.; Reidelbach, John A.; Robins, James E.; Toal, Vincent J.; and Wroblicka, William.

Theta Tau has been active during the past summer. In addition to the regular meetings, a fishing trip was held to acquaint the pledges with Theta Tau. Deacon Ames, Vice Grand Regent of Theta Tau, graciously staged a lawn party and stag outing at his home in Silver Spring. The newly elected officers responsible for this energetic summer program were:

Regent—Merrill Brown
Vice Regent—John Dallas
Scribe—Glen Ballowe
Treasurer—Jim Sinsabaugh
Corresponding Secretary—Merritt Downing
Marshall—Pat Latta
Inner Guard—Claud Dimmette
Outer Guard—Al Tinkelenberg
Council Members—Chuck Appel and Bob Manville

SIGMA TAU

A report on the recent Sigma Tau National conclave, held at the University of Pittsburg, was given at the last meeting of our Xi Chapter by President Ervin Liljegren, the official delegate. The conclave, held on October 7, 8, and 9, was termed, by Liljegren, as the most successful gathering of its type that he had attended. A full program had been planned, and all delegates were required to serve on special conclave committees, hence assuring all of an active part in the affair. Robert Manville, alternate delegate, also attended and staunchly backs up Liljegren in his praise.

Highlighting the fall activities of Xi Chapter will be its forthcoming initiation of new members, followed by a grand ol' engineering style banquet. Principle feature of the banquet, which is usually attended by many alumni, will be the technical papers presented by the initiates. The affair is scheduled for early December and is being arranged by Burr Latta. See you there you alumni!

THE CRIB-SHEET

Here is a complete mess of questions and answers for those who play the "hosses," or as in the vernacular, the crib-minded set. So you know all the answers? With these questions you should. Most of these can be answered either way, so how can you lose. Score yourself according to the correct answers given on page 10: 8 right—super excellent, 7 right—excellent, 6½ right—awful.

1. If you were 20 miles up in an airplane, could you hard boil an egg in water?

2. Volume for volume, which weighs more, wet or dry sand?

3. What causes the hissing sound when a vacuum-sealed can is opened?

4. If a stone is dropped over the edge of a tall shaft will it strike a point at the bottom directly below the point of release? If not, where?

5. Will the weight of a bird flying inside of a container be indicated if the container is placed on a scale?

(Yes, you know the weight of the container alone.)

6. Will placing a silver spoon in a glass tumbler prevent it from breaking when boiling water is poured into it?

7. Is there any sound produced by a tree falling in a forest when no one is there to hear it?

(Ed. note: Surely some one of you must have a few such brain-twisters which you feel should be released on your fellow man. Please send them in to us (with answers), so that we can cause someone a little mental anguish.)

MEET YOUR PROFESSOR

by Art Machlin and Bob Schofield

William Sutton Carley

William Sutton Carley, new Associate Professor in Electrical Engineering, is a very busy young man. In addition to his full-time teaching duties and the long-range job of improving the Advanced Network Laboratory, he is completing a consultant and development project for a transit company in North Carolina, building a 32-tube receiver, and operating a ham station.

His previous training in both the practical and academic fields gives him a broad background for his present position. He was graduated from the University of Kentucky in February, 1942, with a B.S. in E.E. and went to work for the Signal Corps as a Radar Engineer at the Lexington Signal Depot, where he did construction work, maintenance and trouble shooting, and also instructed enlisted Army personnel on the operation and maintenance of radar equipment. In August, 1943, he returned to the U. of Kentucky as an Instructor in Electrical Engineering and part-time graduate student. After completing the requirements for his M.S. in E.E. in September, 1944, he moved on to the Engineering and Agricultural Division of the University of North Carolina as Assistant Professor in Electrical Engineering in charge of the communications option.

In 1947, while teaching at the University at Raleigh, he did consultant work for the North Carolina Department of Conservation, setting up a forest fire reporting link. He also started the previously mentioned job for the Rutherford County Transit Co. on the development of a system of communication of carrier to base. The equipment for this project is at present in the patent stage.

Prof. Carley has been a "ham" since 1936, and has a transmitter in his car as well as in his house in Greenacres, Maryland. He is primarily interested in the high frequencies and operates between 6 and 10 meters. W9WMI are his call letters, in case any of you hams are interested.

Prof. Carley's wife, formerly Marjorie Steele, is not new to Washington, having attended the King-Smith School here after graduation from Transylvania College in Lexington, Ky. They were married in August, 1941, while both were attending the University of Kentucky.

He is a member of the I.R.E. and the Washington Radio Club, and is very effective in obtaining new members for the I.R.E., as many students will testify. Just ask one!

Commander Jerome A. Lee, U.S.N. (Ret.)

Cdr. Lee is one of the latest additions to the Electrical Engineering staff of G. W. U. A native of St. Paul, Minnesota, he has made his home in Washington, D. C. at frequent intervals for the past 23 years.

Mr. Lee graduated from the U. S. Naval Academy at Annapolis with the class of 1913. He remained in the Naval service until 1934 at which time he retired from active duty.

Our new staff member is not a neophyte in the teaching profession. Cdr. Lee was recalled to active service status in 1940 and assigned to the Naval Academy. From 1940 to 1947, he taught the future Admirals fundamentals in Electrical Engineering and Navigation. Cdr. Lee was returned to inactive duty in 1947.

Mr. Lee began his civilian teaching career this fall semester and his present duties involve the instruction of students in E. E. 9 and the handling of Electrical Laboratory groups.

The students in the GWU School of Engineering extend a hearty greeting to Mr. Lee with the sincere hope he will enjoy his future associations with the staff and students alike.

(*Continued from page 1*)

Engineers failed to be promoted in 25% of the cases because of lack of specific skills, whereas in 75% of the cases failure to be promoted was due to character traits. He also mentioned the importance of self-expression to the engineer. He urged the new students present to join the engineering society that represented the field of their proposed activity.

Mr. Goertzenberger mentioned the following objectives of all student branches of the large national engineering societies:

(1) To broaden the student's acquaintance with the practical side of the practice of engineering.

(2) To give each student member the journal of the society and thereby keep him informed about engineering progress.

(*Continued on page 9*)

Marry Not An Engineer

Verily, I say unto you, Marry not an Engineer.
For an Engineer is a strange being and possessed of many evils.
Yea, he speaketh always in parables which he calleth formulae.
He wieldeth a big stick which he calleth a slide-rule, and he hath only one Bible, a hand-book.
He thinketh of strains and stresses and without end of thermodynamics.
He showeth always a serious aspect and seemeth not to know how to smile.
He picketh his seat in a car by the springs thereof and not by the damsels.
Neither does he know a waterfall except by its horsepower, nor a sunset except that he must turn on the lights, nor a damsel except by her weight.
Always he carrieth his books with him, and he entertaineth his sweetheart with steam tables.
Verily, though his damsel expecteth chocolates when he calleth, she openeth the package to discover samples of iron ore.
Yea, he holdeth her hand to but measure the friction thereof, and he kisseth her only to determine the viscosity of her lips, for in his eyes there is a far-away look that is neither love nor a longing expression but rather a vain attempt to recall formulae.
Even as a boy he pulleth a girl's hair but to test its elasticity.
But as a man he deviseth different devices.
For he counteth the vibrations of her heart-strings
As he seeketh ever to pursue his scientific investigations.
Even his own heart flutterings he counteth as a measure of fluctuations.
And he enscribeth his passions as a formula,
And his marriage is a simultaneous equation involving two unknowns.
And yielding diverse results . . .
Verily I say unto you!! Marry Not An Engineer.

AIEE

On Wednesday, Nov. 3, the student branch of the AIEE got off to its first meeting of the new year. Principal speaker for this meeting was Dr. Richard L. Dolecek, head of the Cryogenics Section of the Electricity Division of the Naval Research Laboratory. Dr. Dolecek's subject was Low Temperature Physics, or "Cryogenics," and a very interesting one it was indeed.

The AIEE was very happy to see such a large turnout for the Engineers' Mixer. We were happy also to have signed up so many new members. We hope, however, that the many engineering students who haven't as yet joined the engineering society of their chosen profession will do so in the very near future; the profession needs them and they need the profession.

During the summer semesters the EE's were quiet. Plans for this year were being formulated, however, and include a talk on Printed Circuits, by a member of the Bureau of Standards for the December meeting, and a field trip to be announced.

All AIEE members have been invited to attend the meeting to be held at Lehigh University for the purpose of discussing current student activities. The meeting promises to be very interesting, with many topics of current interest on the aggenda. The dates for the meeting are November 5 and 6, and the transportation will be free.

(*Continued on page 12*)

I.R.E.—Talk on Printed Circuits

On December first the student branch of the Institute of Radio Engineers will present, in cooperation with the Bureau of Standards, one of the most dynamic lectures to be given in recent years at George Washington University. The subject will be "Printed Electronic Circuits," the wartime development in circuitry enabling the use of the famous proximity fuse. Aside from this immediate wartime use, the printed circuit offers tremendous possibilities in modern radio circuits and other electronic devices, several of which shall be demonstrated at the lecture. These circuits take many spectacular forms such as complete transmitters no larger than a pack of cigarettes, ultra high frequency transmitters wired completely on the glass of the tubes, and public address systems small enough to fit on the palm of a hand. The printed circuit has passed the stage of being an interesting novelty and is accepted as a new technique opening wide fields to the designer, and as such, is a topic of importance to undergraduates in most every branch of engineering and physics.

The speaker for this lecture will be Mr. R. L. Henry from the Bureau of Standards. Mr. Henry, a senior member of the I. R. E., is an associate of Dr. Cledo Brunetti, one of the outstanding electrical engineers in the country. Dr. Brunetti regretted that he could not come in person, but sends Mr. Henry with his highest personal recommendation.

Alumni

This problem has stumped some of us but we are sure you can work it??? If you can, drop us a line with your solution and some news about yourself. All alumni who answer the problem correctly will appear in our puzzle-busters column next issue. We will be delighted to try your favorite puzzle in later issues so send them in, with answers, of course.

If a farmer wishes to buy 100 head of livestock and has but $100.00 to spend; how many of each will he buy at the following prices; cows $10.00; pigs $3.00, and chickens $0.50.

Our address: Mecheleciv, George Washington University, Washington, D. C.

Maybe you've heard this one before, but have you ever solved it?

William Chester Thom, BS, in CE '04, CE '05, received the Alumni Achievement Award for outstanding accomplishments in the field of engineering at the May Convocation. He is Chief Engineer at the U.S. Naval Gun Factory in Anacostia, D. C.

Howard P. Safford, BS '12, EE '17, recently retired as Associate Superintendent of Schools in the District of Columbia after long educational service. He had been a teacher of mechanical drawing at McKinley High School and Principal of MacFarland Junior High School here before serving as superintendent in charge of buildings and grounds.

Jack M. Bane, BME '48, has recently completed three months of training in sales engineering with the Texas Oil Co. During his training he was sent to various parts of the country to visit the companies' plants, field offices and laboratories. He is now working for their field office in Albany, N.Y.

Robert Sale, BEE '48, is training as a research engineer with RCA in Camden, N.J.

Phil Osborne, BME '48, is taking post graduate work at the University of California in Berkeley.

Elmer Sunday, BME '48, is working at the New Jersey Zinc Co. in Palmerton, Pa., developing zinc processing equipment.

Fremont Jewell, BCE '48, also way out west in Denver, Colo., where he is employed by Crocker and Ryan, consulting engineers. His present job is on a highway project.

Scott Ebrite, BEE '48, is working in GE's new high voltage laboratory in Pittsfield, Mass. This lab is reputed to be the largest of its kind in the country.

Dwin Craig, BS '48, recently completed a seismograph project at the Reed Institute in Georgetown where he does research work in electronics.

STREAM GAGING

by R. H. Volin

Many engineering students are familiar with the primary function of the United States Geological Survey; that of surveying our land. Another of its functions is stream gaging. During the past summer, I worked for the Stream Gaging Service in Pennsylvania as a Hydrologic Field Assistant. This sounds rather immense, but actually the job consisted of making repairs to the Water Gaging Stations, pumping and cleaning the wells, and taking stage readings of streams.

The function of stream gaging is to measure the velocity of flow of the stream, and the height of the various streams in the country. These measurements are made at certain stations known as gage houses. In Pennsylvania, these gaging stations are maintained in conjunction with the Pennsylvania Department of Forest and Waters. Some few were also maintained in conjunction with the U.S. Army Engineering Corps and the United States Weather Bureau.

A gage house is a small building, approximately five feet by five feet, which sits directly over a reinforced concrete well, the depth of which varies roughly from ten to forty feet, depending on the location. A wood floor divides the well from the gage house, which is made of brick, concrete blocks, or reinforced concrete.

One of the important instruments in a gage house is the Continuous Stage Recorder, which contains a graph with abscisas plotted for height of water and ordnates plotted for time of day. A pen for recording the information is actuated by a cylindrical cam, which moves the pen to the right and left, and a clock, geared to a take-up roller, which advances the chart through the day. In operation, the cam actuating the pen is geared to a drum on which is mounted a steel wire that leads down to a float in the well. As the float moves, the drum takes up this chain, which in turn causes the cylindrical cam to rotate, causing the pen to move up or down the graph a proportional amount. The cam itself has two helical grooves along its entire length: one going in the direction of increasing stage, and the other in the direction of decreasing water stage. The pen rests on a bar which follows a

(Continued on page 10)

Herb Murray, BME '48, has moved across the campus to Stockton Hall where he is working on a law degree at night.

John Glessner, BME '48, is now working in the research and development department of the aerodynamics division of the Elliot Company in Jeannette, Pa.

WE FRESHMEN

by Lloyd Harker

"Like all the jolly fellows,
I drink my coke clear . . ."

Yep, us engineers had a rip roaring mixer party the other night. We had a couple of hours of introductions and speeches, then retired to the basement for the "Pottie." The speeches all stressed one point, which was, as well as I could gather, that something was here to stay, and we should all take part in it. After the first half hour the smoke got so thick I couldn't make out the speakers. I could hear them fairly well though, and it was fun guessing what those voices' faces looked like, but I just might have missed the main point through it all.

After the meeting at Cor. Hall, refreshments were served across the street at the Night Club; that's the Student Club with one light turned off. I left the speeches a little early because I figured I'd get lost. I did. Took the wrong turn, and ended up at the White House. I saw Harry and asked him how the balcony was. "Son," he said, "I don't care where that 80th Congress goes, I'll be right here." I thought he was a little confused, but now, "I told you so."

Things were getting pretty noisy when I finally got to the party. Most of the guys had already had two or three straight cokes and were feeling rather gay. So saying, I dropped an aspirin into my first one and was soon feeling as devil-may-care as the next bloke. There were a lot of stands-around with guys trying to get other guys to sign up in the engineering societies. Someone insisted that that was what the speeches were about, the advantages of the societies and all that. I told him he couldn't be right about the speeches; I'd been there. After he got off my chest he finally confessed that he was president of the EIAS. (Engineers' Institute of Alcoholics Synonimous).

I got to talking to a couple of pre-meds who had gotten wind of the free pretzels, and they were really impressed with the amount of cokes the engineers were drinking. "Liable to get a little rough, isn't it?" one of them said. I tossed off another big hooker of the stuff and gave him the old steady grin. Don't worry, brother. We could take it.

Time whizzed by and pretty soon it was 10:30 and time to be heading for the old sack. One by one we strapped on our "guessing sticks" and, staggering ever so slightly, went home to dream about our first party with the Engineers in '48.

"Oh yes, I'm quite a gun from Washington. And a Hell of an engineer."

ASME

MECHANICAL ENGINEERS have rolled merrily along since the last issue of the MECHELECIV. Eighteen of our boys graduated in May and eleven more grasp the old skin November 11. The latter are:

John J. Ciofoi, Francis C. Falkinburg, Wallace T. Geyer, William S. Guerrant, Phillip W. Osborne, Elmer G. Sunday, Raymond A. Coulombe, William E. Gaines, John W. Glessner, Dwight F. Hastings, Matthew S. Polk.

The grapevine tells us that Norman Zeigler got married a while back, and that Bill Vogel combined a honeymoon with breaking in a new car last July. Former ASME prexy Herb Murray became a father.

The chapter has again elected new officers, and they are:

President	Merritt Downing
Vice-President	Ben Cruickshanks
Secretary	Frank Braugh
Treasurer	Victor Reddle

Chapter plans are in full swing. At the meeting November 3, Mr. Frank R. Caldwell of the National Bureau of Standards spoke on "Combustion in Moving Air," boosted by slides and a question-and-answer session.

Also on the docket was the party with our parent chapter on Wednesday, November 10, which featured beer and entertainment. Admission to this was $.50, plus student membership card. Here's hoping you all enjoyed yourselves.

(*Continued from page 6*)

(3) To develop the student's initiative and ability to speak in public, and to familiarize him with the parliamentary procedure and organization of learned societies.

(4) To enable the student to establish fraternal contact with fellow students in engineering, both at his Alma Mater and at other colleges, and to meet graduate engineers engaged in the active practice of engineering.

(5) To permit the student to attend meetings of Student Branches and also the meetings of the society, its sections and professional divisions.

Mr. Goertzenberger believes that an engineer is, above all, a member of society, and as such he should cooperate with other men of earnestness and good faith to advance its interests, to improve the welfare of the community, and to do all in his power to make the world a better place in which to live.

Mr. Goertzenberger gave an excellent account of the organizational setup of the Engineers' Council for Professional Development, which

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The Crib-Sheet
ANSWERS

1. Twenty miles up the atmospheric pressure is so low thot woter would voporize immediotely, hence it would be slightly difficult. If you said yes, you're probobly on old know it all who would be in a pressurized cabin in the first place.

2. When sond is dampened moderately, its volume increoses out of oll proportion to the omount of woter odded, and the wet sand would weigh less thon the dry sand. If the sond is thoroughly saturated, so thot all the voids are filled, the wet ond dry sond will weigh approximately the same. Which only goes to show that even though you moy get-saturated, you still hoven't got too much weight to throw oround.

3. It is coused by oir rushing into the con. However, there is one exception. Sometimes vacuum-packed coffee generotes goses ofter it hos been pocked, ond the hissing in this case is caused by these goses escoping. All right, so you buy yours by the bog. Either thot, or you don't drink —coffee.

4. The eorth rotates from west to eost. The stone will strike a point which is easterly of the point directly below, becouse since the earth is rototing, the stone hod o lorger horrizontol velocity component thon did the point below it. If you're wrong this for, you're too lote to rush down ond cotch the stone and place it where you wont it. You'll have to settle for a true or false answer.

5. If the container is open, the answer is no. If it is a closed container, the weight of the bird will be indicoted whether the bird is flying or not. If you now reply thot this was o Do-do bird which is extinct, you may now answer the question: Does odor have weight? The onswer is still yes.

6. The household answer would be yes, because the spoon would obsorb and conduct away part of the heot. The efficocy of silver, or any other metol, is doubtful, because the quontity of heat thot would be lost in this woy is olmost negligible when compored to the total quontity of heot in o glass full of hot woter. Moral; even those born with a silver spoon in their mouth can sometimes go off holf crocked, pordon, crocked, obout something.

7. There ore two definitions of sound. In one case sound is o sensation, and the onswer would be no. In the other case sound is the woves which stimulote the sensation, and the onswer would be yes. It boils down to whether you prefer being sensoted, or merely the prospect.

(Who said there were eight questions?)

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lug rider in the helix of the cylinder, thus causing the pen to move when the cylinder rotates. One inch on the chart represents one foot of rise or fall of the water stage, hence a twelve to one train of reduction gears is used between the drum on which the steel chain is spooled and the cylinder.

When a water stage recording is made, the top gage, an outside gage near the gage house, is also read. This outside gage consists of either a timber slope gage or a chain gage mounted on a bridge. A weight on the chain is lowered until it just skims the water surface. A rivet on the chain is pulled taunt and held horizontally as a reading is taken opposite a number on an enameled staff gage.

In taking the stream flow velocity measurements, a current meter is used. The current meter is a long slender rod upon which are mounted four propellors, which are caused to rotate when the water impinges upon them. The engineer counts the clicks of rotation with a set of earphones. In taking the flow measurements, the engineer wades into the water to a certain stage, or takes them from a go-cart. This is a cart suspended by two wheels from a cable. The purpose of these measurements is to record the water stages and velocity of flow of the streams

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was chartered as "a conference body organized to enhance the professional status of the engineer through the cooperative support of those national organizations directly representing the professional, technical, educational, and legislative phases of an engineer's life." He also gave a brief account of the objectives of the Engineers Joint Council, a body composed of three delegates from each of the following societies: ASCE, ASME, AICHE, AIEE, and AIME, with the basic idea of promoting more active participation in the shaping of national and world policies by engineers.

Following the talk there was a lively discussion period in which many students, as well as Dean Feiker and Professor Greenshield. participated. It was a timely subject, well received by students and faculty alike.

on the graphs, called stream performance curves.

In order to build hydroelectric dams, the velocity of the streams must be known. One of the problems here is predicting the maximum flood stages, and by studying these curves it is possible to make accurate predictions for the many years in the future.

A NEW ANGLE MEASUREMENT METHOD

by E. H. Mullins

Modern engineers are often faced with problems of a unique nature to which solutions peculiar to that specific problem must be found. As a specific example let us assume a problem as follows: Let it be required that our engineer must conceive of an idea and incorporate this idea into a workable design of an instrument that is capable of measuring and recording the initial inclination angle, and subsequent changes of this angle with respect to time, of a moving object such as a torpedo, rocket, airplane, raft or battleship to an accuracy of .002 of a degree.

The specifications require that the instrument must operate over a temperature range of minus 40°F to 150°F, that the weight shall not exceed 10 lbs., that the volume occupied shall not exceed 200 cubic inches, that failure of the mechanical or electrical component parts will not occur when subjected to an acceleration of 600 g's, and that the instrument be housed in a water-tight container capable of withstanding salt spray or water pressure of two atmospheres over a period of 72 hours.

A careful investigation of the principle of the simple pendulum reveals several modifications which when adapted to certain applications will give a reliable and accurate method for measuring angular position. It was recognized that a free falling body is effected only by the force of the resultant acceleration which in many instances is only the force of gravity, maintaining unchanged during its fall any horizontal velocity it may have had at the instant of release. and accordingly, might be treated as a pendulum during the time of flight. A series of free falling bodies might in turn, be considered as a series of pendulums, each uneffected by the history of the previous one, and each of relatively short time duration.

If a target assembly is rigidly attached to the point of release of the free falling body and the entire assembly tilted, the distance from the point of impact with the assembly tilted to the point of impact with the assembly vertical will be proportional to the angle of tilt. This distance can be computed by formula.

While such a measuring system is not effected by the previous accelerational history, this system is effected by accelerations undergone during the time of body flight. The error produced by a constant horizontal acceleration of the target during this time interval can also be computed from formula.

A sample calculation will show that the angle of error is appreciable. Assuming acceleration equals 1 ft./sec^2.

If, however, the accelerations are vibratory and the angle being measured holds constant over an appreciable length of time, an average of the angles indicated by a number of drops will cancel out the acceleration errors and will yield measurement of the desired angle within the basic accuracy of the instrument.

The Torpedo Recording Inclinometer is an instrument designed to measure the inclination angle of a test running torpedo. The Inclinator utilizes the fundamentals described in the paragraphs under principle of operation and depends upon the gravity field as a reference. Precise spheres (5/32 in. diameter stainless steel balls) are dropped singly onto a moving constant speed, electric motor driven waxed tape, whose movement is in a plane perpendicular to the normal line of ball flight. Various tape speeds and ball drop rates are possible by changing the tape drive gearing ratio and the ball drop actuating cam. For a normal test run, a tape speed of one inch per second and a ball drop rate of one per second are used. From the tape, the balls roll off and fall into a receiving hopper in the bottom of the instrument.

The essential components of the instrument are as follows:

(a) A ball release mechanism whose function is to release successive balls from the same rest position without imparting a spin, or spurious accelerations.

(b) A ball hopper and ball feeding mechanism which provides a ready supply, in the form of a vertical column of several balls, for the release mechanism trigger slide. The main hopper may contain several thousand balls at the beginning of a run.

(c) A constant speed tape driving mechanism, with friction clutch drive on the take-up and release spool assemblies.

(d) A cam lever assembly, which operates a ball release and feeding mechanism at chosen relative speeds and forms an integral part of the constant speed driving unit.

(e) A 6 volt D.C. governor controlled motor which serves as the mechanism driving source.

(f) An adjustable center-line stylus assembly which marks the base line from which the ball imprint displacements are measured.

(g) Any auxiliary equipment that may be

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desirable, such as, a time pulse switch operating from the ball release cam assembly for coordination time pulse marks on allied recording equipment, and a hydrostatic or inertia switch for starting the mechanism and a fuse contact assembly for stopping it at the completion of a run.

The operation of the instrument is entirely automatic other than the initial loading of the tape and balls. The instrument is housed in a watertight compartment and is mounted upon a pivot system whose axis is parallel to the longitudinal axis of the torpedo. thus allowing for roll of the torpedo while maintaining the target area essentially normal to gravity. The base line is adjusted so as to coincide with the ball imprints when the torpedo is at rest, in a true horizontal position. The mechanism, being started by water pressure, drives a two inch wide waxed tape at a constant speed of one inch per second in a perpendicular transverse direction to the vertical line, as determined by the normal ball flight. The ball feed and ball release mechanisms are operated simultaneously by the cam lever assembly at one cycle per second. When the tape supply is exhausted, a contact closes blowing a fuse, thus stopping the entire mechanism and avoiding possible damage to the target area from direct contact between the falling balls and the target surface.

For calibration the instrument and power supply were installed in their watertight compartment in the torpedo exercise head. The entire torpedo was assemblied and special conical pointers were inserted in the nose and tail to define the longitudinal axis. The distance between these pointers was carefully measured by means of a steel tape and plumb bobs. The torpedo was then leveled on an adjustable stand, the level being determined by a water level consisting of two glass tubes connected by rubber tubing. After leveling the torpedo, the instrument was run for approximately 90 seconds to establish a series of drops corresponding to the base line, then a series of several up and several down angles were run, covering a range of approximately 6 degrees up and 4 degrees down. No attempt was made to arrive at a definite angle. The angles attained were determined by measuring the difference in elevation between the nose and tail pointers and the measured length between these pointers.

After the run, the tape was removed from the instrument and placed on the stage of a toolmaker's microscope. The deviation of the impact point of each ball from the scribed reference line was read to the nearest 0.0001 inch and the corresponding angles computed. A theoretical drop distance was computed based upon the ball imprint displacement and the angles measured directly on the torpedo. Using this drop distance, satisfactory correlation was obtained between the angles measured by the instrument and angles measured directly on the torpedo. The probable error of any single drop was determined to be 0.025 degree and the probable error of an average of 50 consecutive drops at the same torpedo angle was determined to be 0.002 degree.

The Torpedo Recording Inclinometer is only one specific application of the principle utilized in this device. It is conceivable that many similar applications might be used where it is desired to measure precisely the angle of tilt of some object difficult to get at, or remotely located. Such applications might be, to find the angle of tilt of an oil well shaft at a point several hundred feet below the earth's surface. the angle of tilt of a submarine periscope sighting head, the angle of inclination of a model plane or glider when towed by a mother plane or the angle of inclination of a guided missile during steady-state flight conditions.

The chief advantages of the principle utilized in the Torpedo Recording Inclinometer are: First, the angular position is indicated by a series of nearly instantaneous pendulums where each has a 0.166 second time duration and where each is uneffected by the history of the previous one. This eliminates the oscillatory errors experienced by the conventional pivoted pendulum; and secondly, the ball imprint becomes a permanent record of a function of angular position of the instrument at the time of ball release, thus, it is a simple direct recording device, which eliminates the disadvantages often associated with telemetering and recording of signals, which have to be relayed from remote points to the final recording apparatus.

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At the last meeting, held in May, the officers for the current year were elected. They are:

Chairman	Larry Brown
Vice-Chairman	Bill Klein
Secretary	Leonard Somers
Treasurer	John Dallas
Engineer's Council	Matt Flato & Bill Klein
Members at Large	Matt Flato & Herman Schkolnick